

Appl. No. 10/815,164  
Response Dated March 20, 2008  
Reply to Office Action of November 20, 2007

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The Office Action of November 20, 2007 has been thoroughly studied. Accordingly, the changes presented herein for the application, considered together with the following remarks, are believed to be sufficient to place the application into condition for allowance.

Claims 1-3, 6-10, 15 and 17 remain pending in this application.

Claims 1-3 and 6 stand rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 6,489,436 to Lin et al.

Claims 7-10 and 15 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Lin et al. as applied to claims 1-3 and 6 and further in view of U.S. Patent No. 5,290,909 to Chen et al.

Claims 1-3, 6, 10, 15 and 17 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 4,937,133 to Watanabe et al. in view of Lin et al.

For the reasons set forth below, it is submitted that all of the pending claims are allowable over the prior art of record and therefore, each of the outstanding rejections of the claims should properly be withdrawn.

Favorable reconsideration by the Examiner is earnestly solicited.

The Examiner has relied upon Lin et al. as disclosing:

...a metal laminate for use in a flexible wiring board, the laminate comprising a polyimide copolymer laminated with a metallic foil. The polyimide copolymer is a product of (1) a copolymer of (A) isopropylidene-bis-4-phthalic acid dianhydride and (B) 3,3',4,4'-benzophenonetetracarboxylic acid dianhydride, and (2) (C) 6-amino-2-(p-aminophenyl)-benzimidazole (see abstract).

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Component (B) is used not more than 90% (see col. 2, ln. 14-16), giving the amount of (A) to be at least 10%, which read on the instantly claimed ranges.

Lin further teaches the laminate to be without curling and the polyimide layer is a single layer (see Example 1; col. 5, ln. 1-9). With respect to the polyimide copolymer being subjected to an etching process to obtain curling resistance, it has been within the skill in the art that process limitations would have no patentable weight in an article claim so long as the article is free of curling.

Jenq-Tain Lin is a common inventor with the Lin et al. reference and the present, commonly assigned, application. Moreover, the subject matter of Lin et al. is discussed on page 3 of the present specification.

Accordingly, the present applicants are familiar with the teachings of the Lin et al. reference.

The Examiner states that Lin et al. teaches a polyimide copolymer made from the applicant's claimed mixture of anhydrides (A) and (B) and diamine (C).

This statement is much broader than the teachings of Lin et al. and an improper (unsupported) interpretation of Lin et al.

Lin et al teaches a:

... polyimide copolymer, which is a copolymer of isopropylidene-bis-(4-phenyleneoxy-4-phthalic acid)dianhydride and 6-amino-2-(p-aminophenyl)benzimidazole or a copolymer of two kinds of tetracarboxylic acid dianhydrides consisting of isopropylidene-bis-(4-phenyleneoxy-4-phthalic acid)dianhydride and 3,3',4,4'-~~benzophenone~~tetracarboxylic acid dianhydride and 6-amino-2-(p-aminophenyl)benzimidazole. (See Abstract)

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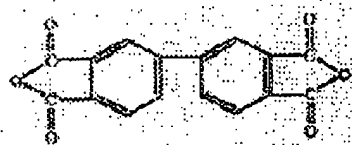
Applicants' independent claims 1, 7 and 17 require two kinds of tetracarboxylic acid dianhydrides consisting of (A) isopropylidenebis (4-phenyleneoxy-4-phthalic acid) dianhydride and (B) 3,3',4,4'-biphenyltetracarboxylic acid dianhydride.

The 3,3',4,4'-benzophenonetetracarboxylic acid dianhydride used by Lin et al. is not the same as the 3,3',4,4'-biphenyltetracarboxylic acid dianhydride used by applicants and required by each of the independent claims.

3,3',4,4'-benzophenonetetracarboxylic acid dianhydride is represented by the following formula:



3,3',4,4'-biphenyltetracarboxylic acid dianhydride is represented by the following formula:



The Examiner will note the differences in structure which result in differences in functional properties and characteristics.

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A careful review of Lin et al. will reveal that this reference completely fails to teach applicants' 3,3',4,4'-biphenyltetracarboxylic acid dianhydride.

Accordingly, Lin et al. does not anticipate applicants' claimed invention.

In response to the Examiner's reliance upon Lin et al., applicants have conducted a comparative example in which Jenq-Tain Lin has directly over seen and controlled the experimentation.

In these comparative example, a solution containing 260.0g (0.5 mole) of (A) isopropylidenebis (4-phenyleneoxy-4-phthalic acid) dianhydride and 780.0g (1.5 moles) of (B') 3,3',4,4'-benzophenonetetracarboxylic acid dianhydride in 8,430 ml of N-methyl-2-pyrrolidone were charged into a four-necked flask having a capacity of 10 L and provided with a stirrer in a nitrogen gas-flushed atmosphere, and then 448.0g (2.0 moles) of (C) 6-amino-2-(p-aminophenyl)-benzimidazole was charged into the flask while keeping the temperature below 60°C. The resulting mixture was stirred at room temperature for three hours to obtain 9,420g of a varnish-state polyimide precursor copolymer solution (viscosity at 25°C: 3,250 cps; concentration of solid matter: 15 wt.%).

The polyimide precursor copolymer solution was applied to a roughened surface of rolled electrolytic copper foil (product of Furukawa Electric Co., Ltd.; thickness: 10 µm) with a coat thickness of 18 µm using a reverse type roll coater and then the solvent was continuously removed therefrom through a hot air drying oven at 120°C, followed by heat treatment up to 400°C over 10 minutes to form a 12.5 µm-thick polyimide layer on the copper foil.

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The copper foil/polyimide laminates obtained in the forgoing process were subject to etching and the testing as taught in applicants' Example 2. The results of the testing are as follows:

Curling was tested as follow: A laminate 5 x 5 cm and a film thereof after etching were gently placed on a horizontal flat base to bring the laminate and the film into a concave state thereon and the height of curling was measured without applying any particular external thereto.

The results of the above comparative example and Example 2 on page 10 of applicants' specification are shown in the following Table:

Determination/Observation Item	Example 2	Comparative Example
T <sub>g</sub> (°C)	323	260
CTE (ppm/°C)	17	32
Adhesive Strength (Kg/cm)	1.92	1.31
Elongation at Break (%)	36	24
Water Absorbability (%)	3.36	5.15
Percentage Shrinking after Etching		
MD Direction (%)	0.099	0.060
TD Direction (%)	0.061	-0.038
Percent Heat Shrinking		
MD Direction (%)	0.121	-0.038

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TD Direction (%)	0.05	-0.057
Curling		
Laminate (mm)	0	4.8
Film (mm)	0	7.4

As can be readily seen from the above comparative example, the use of the 3,3',4,4'-benzophenonetetracarboxylic acid dianhydride of Lin et al. in place of the 3,3',4,4'-biphenyltetracarboxylic acid dianhydride of the present invention results in significantly poor performance characteristics.

Thus, applicants' use of 3,3',4,4'-biphenyltetracarboxylic acid dianhydride clearly provide unexpected results as compared to Lin.

The Examiner has relied upon Chen et al. as disclosing:

...polyimide film compositions applied to metallic foil substrates comprising the reaction product of applicant's claimed components (B), (C), (D1), and (D2) (abstract; example 1). Examples show the applicant's claimed ratios of (C) to (D1) or (D2) (examples 1-2).

In combining the teachings Lin et al. and Chen et al. the Examiner takes the position that:

...it would have been obvious...to have employed at least (D1) or (D2) in combination with (C) as the diamine component of Chen in the polyimide of Lin. The reason for that combination of two components of the same purpose has been considered prima facie obvious of providing the same purpose.

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It is noted that applicants' Comparative Example 5 on page 17 of applicants' specification is essentially an example of Chen et al.

It is noted that the results of Comparative Example 5 are significantly poor as compared to applicants' claimed invention.

Thus, it is submitted that applicants' invention provides unexpected results over each of Lin et al. and Chen et al. alone or in combination. These unexpected results, which are based upon the characteristics and properties of applicants' claimed metal laminate, patentably distinguish applicants' invention over the prior art.

The Examiner has relied up Watanabe et al. as disclosing:

...a printed circuit base, comprising a layer of polyimide and a conductive layer. The polyimide layer is formed by first forming a solution of polyimide in a solvent (DMAC), applying the polyimide solution on copper foil, heating to imidize the polyamic acid (see Examples 1-7). The laminate is then subjected to etching and does not curl, twist, or warp (see abstract; col. 2, ln. 28-32).

Watanabe et al. corresponds to JP-B-5-22399 which is discussed on page 2 of applicants' specification.

As discussed:

JP-B-5-22399, JP-B-6-93537, JP-B-7-39161, etc. disclose metal laminates with distinguished dimensional stability, adhesiveness, flatness after etching, reduction in curling, etc., manufactured by forming a plurality layers of a polyimide resin layer having low thermal expansion and other polyimide resin layers on a conductor, where two or three kinds of polyimide precursor copolymers must be used, the individual copolymer solutions must be applied one by one to the conductor to form an insulation multilayer, and a ratio in thickness of the resulting individual polyimide

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layers must be specified, inevitably complicating the manufacture of the metal laminate thereby.

The present invention, as now claimed, requires only a single layer of polyimide to resist curling. This provides an obvious advantage over the complicated process taught, and believed to be necessary, by Watanabe et al.

Applicants' claimed invention excludes the multiple layers of polyimide that are required by Watanabe et al.

On page 4 of the Office Action the Examiner has stated:

The lamination of Watanabe comprises at least two layers of polyimide resins, not a single layer. However, making integral of separate parts would not be patentable over the prior art since the combined layer would have the same insulating function.

The Examiner's opinion of Watanabe et al. completely ignores the fact that Watanabe et al. requires two separate layers of polyimide resins that have different thermal expansion coefficients.

Thus, it would go against the teachings of Watanabe et al. to make the two layers of polyimide a single integral layer as the Examiner suggests.

Should one modify Watanabe et al. to have a single polyimide layer, the result would be the prior art which Watanabe et al. disclose that has the disadvantages that Watanabe et al. overcome by using two layers of polyimide that have different thermal expansion coefficients.

Based upon the above distinctions between the prior art relied upon by the Examiner and the present invention, and the overall teachings of prior art, properly considered as a whole, it is



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respectfully submitted that the Examiner cannot rely upon the prior art as required under 35 U.S.C. §102 as anticipating applicants' claimed invention.

Moreover, the Examiner cannot rely upon the prior art as required under 35 U.S.C. §103 to establish a *prima facie* case of obviousness of applicants' claimed invention.

It is, therefore, submitted that any reliance upon prior art would be improper inasmuch as the prior art does not remotely anticipate, teach, suggest or render obvious the present invention.

It is submitted that the claims, as now amended, and the discussion contained herein clearly show that the claimed invention is novel and neither anticipated nor obvious over the teachings of the prior art and the outstanding rejection of the claims should hence be withdrawn.

Therefore, reconsideration and withdrawal of the outstanding rejection of the claims and an early allowance of the claims is believed to be in order.

It is believed that the above represents a complete response to the Official Action and reconsideration is requested.


If upon consideration of the above, the Examiner should feel that there remain outstanding issues in the present application that could be resolved; the Examiner is invited to contact applicants' patent counsel at the telephone number given below to discuss such issues.

To the extent necessary, a petition for an extension of time under 37 CFR §1.136 is hereby made. Please charge the fees due in connection with the filing of this paper, including extension of

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time fees, to Deposit Account No. 12-2136 and please credit any excess fees to such deposit account.

Respectfully submitted,

  
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